The Granular Cosmic Vacuum

Chabane Dahli
dahlichabane70@gmail.com
Independent Researcher, Algeria

February 8, 2026

Abstract

We propose that the apparent empty intergalactic voids (P2) are not a smooth Einsteinian spacetime with a quantum-field vacuum, but a granular lattice of microscopic white holes (MWs) – quanta of the pure cosmic vacuum – each formed by the superposition of three mass-branes and stabilized by three contracted temporal strings. Within galaxies (P1), standard GR + QFT + the Standard Model remain valid and fully successful; the failures of ΛCDM arise when those theories are forced to describe the P2 domain. This structural separation naturally explains the absence of particle dark matter and predicts two observable consequences: 1) a small, distance-dependent extra attenuation of TeV γ-rays from distant blazars/GRBs, and 2) a sub-percent modification of the Casimir force at 100 nm–1 μm. Both effects provide laboratory and astrophysical tests of the granular vacuum hypothesis.

Keywords: Granular vacuum; Microscopic white holes; String photons; Dark energy; Dark matter; Casimir effect; Intergalactic voids; Domain structure of spacetime; String–membrane cosmology

1 Conceptual Framework (Desert–Mountains Analogy)

You propose a structural cosmology in which:

1.1 Dry land = Einstein spacetime (Pattern P1)

Inside galaxies, standard GR + QFT + Standard Model work perfectly. This is the smooth land where all conventional physics lives.

1.2 Mountains = Composite strings supported by contracted membranes (dark matter, Pattern P3)

At galaxy edges and halos, three contracted spatial membranes combine into a closed membrane (3→1 rule), whose pressure mimics dark matter. The mountains are these massive membrane–string complexes.

1.3 Desert = Intergalactic vacuum (Pattern P2)

The apparent empty regions between galaxies are not truly empty. They are:

- **Granular**: made of microscopic white holes (MWs) = quanta of the cosmic vacuum, each a stacked mass membrane (three mass-branes in superposition).
- Each MW is stabilized by three contracted energy strings (temporal strings). These three strings are the structural origin of what appears as dark energy tension.

Thus, the intergalactic vacuum is a granular network:

Desert = lattice of microscopic white holes (stacked mass membranes) each supported by 3 contracted temporal strings.

This leads directly to observable consequences because photons and fields do not cross a smooth continuum; they cross a discrete string–membrane lattice.

2 Domain Structure: Where Your Model Applies

- **Inside galaxies (P1):**
  - 4D Lorentzian manifold $(M, g_{\mu\nu})$.
  - Quantum fields, Hilbert space, entanglement, Standard Model particles.
  - GR + QFT are valid and accurate.
- **Between galaxies (P2 – temporal cosmic realm):**
  - No QFT vacuum, no virtual particles, no Hilbert space.
  - Fundamental entity: closed temporal string formed by ternary composition of 3 contracted temporal strings.
  - Dark energy = tension of this closed temporal string, not vacuum energy.
  - Photons here are string photons: classical waves of temporal tension, not quantum field excitations.
- **Galaxy edges/halos (P3 – spatial cosmic realm):**
  - No dark matter particles; fundamental entity is a closed spatial membrane (3 contracted membranes $\rightarrow$ 1).
  - Membrane pressure reproduces flat rotation curves and lensing without particles.

Your granular vacuum picture is therefore a P2 statement: the desert between galaxies is a lattice of MWs + contracted strings, not a smooth QFT vacuum.

3 Granular Vacuum Hypothesis

3.1 Microscopic White Holes as Vacuum Quanta

- Each microscopic white hole (MW):
  - Is a quantum of the cosmic vacuum (a grain of the desert).
  - Ontologically = 3 mass membranes in superposition (stacked branes).
  - Represents a local patch of pure vacuum structure (no dark energy inside in the ideal limit).

3.2 Stabilization by three contracted strings

- Each MW is not free; to be stable it must be held by 3 contracted temporal strings (3$\rightarrow$1 rule in the temporal sector).
- These 3 strings encode cosmic time tension. Their effective large-scale tension T_e yields the observed dark-energy density $\rho_\Lambda \sim T_e/R_H$.
- This makes the vacuum granular + tense: granules (MWs) + a web of contracted strings.

3.3 Effective Structure Seen by Radiation

For any wave crossing P2 (e.g. a high-energy photon):

- It does not propagate in a smooth metric + QFT background.
- It propagates as a string excitation on the temporal string network, passing through, and interacting with, the MW granules.

This motivates two main experimental tests:

1. High-energy γ-ray propagation through the granular vacuum.
2. Casimir force modification due to vacuum granularity on sub-μm scales.

4 Test 1 – High-Energy Gamma Rays as String Photons

4.1 Standard ΛCDM Expectation

In ΛCDM + QFT:

- High-energy γ-rays from blazars or GRBs propagate through a smooth FLRW spacetime with a QFT vacuum.
- Main attenuation mechanism at $E \gtrsim$ TeV:

$$\gamma + \gamma_{\text{CMB/EBL}} \to e^+ + e^-$$

- Pair production on the CMB and extragalactic background light (EBL) gives an optical depth $\tau_{\text{pair}}(E, z)$.
- Predicted observed flux:

$$F_{\Lambda\text{CDM}}(E, z) = \frac{F_{\text{em}}(E) e^{-\tau_{\text{pair}}(E,z)}}{4\pi D_L^2(z)}.$$

4.2 Your Model: String Photons in a Granular Vacuum

In your P2 domain:

- When a photon exits a galaxy, it transitions:
  - P1: QFT photon, quantum state $|\psi\rangle$.
  - P2: string photon = geometric wave on the temporal string; no Hilbert space, no entanglement.
- Intergalactic voids contain:
  - A dense lattice of MWs (white-hole granules).
  - A network of 3 contracted temporal strings stabilizing each MW.

A γ-ray passing through this lattice experiences:

- Standard pair-production attenuation $\tau_{\text{pair}}(E, z)$.

- Additional string-tension damping: energy loss / amplitude damping due to interaction with the temporal string network and the granular MW distribution.

We introduce a damping parameter γ_N that quantifies the cumulative energy loss as radiation propagates through the granular vacuum. You can model the extra attenuation by a factor:

$$\Gamma(D, E, \gamma_N) = \exp\left(-\gamma_N f(D, E)\right),$$

where:

- D = propagation distance (e.g. comoving or luminosity distance).
- E = photon energy.
- $\gamma_N \ll 1$ is the cumulative damping coefficient, encoding tension damping over N hierarchical structural steps from Planck to Hubble scale. This parameter characterizes the strength of photon interaction with the MW lattice and string network.
- $f(D, E)$ is a dimensionless function that grows with distance (more MWs crossed) and may have weak energy dependence.

Thus the observed flux becomes:

$$F_{\text{obs}}(E, z) = \frac{F_{\text{em}}(E) e^{-\tau_{\text{pair}}(E,z)}}{4\pi D_L^2(z)} \Gamma(D_L(E, z), E, \gamma_N).$$

4.3 Concrete Observational Strategy

1. Select sources:
   - Blazars / AGNs with good redshifts over a range $0.1 \lesssim z \lesssim 2$.
   - Prefer sources with well-constrained intrinsic spectra (multiwavelength modelling).
2. Collect γ-ray spectra:
   - Use Fermi-LAT for GeV–sub-TeV, where pair-production is modest.
   - Use HESS/VERITAS/MAGIC/CTA for TeV–10s of TeV, where attenuation is strong.
3. Fit standard model first:
   - Assume intrinsic spectral shape (e.g. power law with cutoff) and apply only $\tau_{\text{pair}}(E, z)$ from ΛCDM.
   - Derive residuals:
   $$R(E, z) \equiv \frac{F_{\text{obs}}(E, z)}{F_{\Lambda\text{CDM}}(E, z)}.$$
4. Search for systematic excess attenuation:
   - If vacuum is smooth: $R(E, z) \approx 1$ after including all astrophysical corrections.
   - In your model: expect a small, roughly distance-dependent suppression:
   $$\ln R(E, z) \approx -\gamma_N f(D_L(E, z)).$$

- Check whether $R(E, z)$ deviates from 1 in a way correlated with distance, not just energy.

5. Interpretation:
   - A redshift-dependent extra suppression, stable across many sources and robust against source modelling, supports the idea of string-photon damping in a granular vacuum.
   - If no such suppression is seen within experimental precision, this constrains or rules out your specific values of γ_N and the strength of granularity.

5 Test 2 – Casimir Effect with a Granular Vacuum

5.1 Standard QED Casimir Effect

In QED with a continuous vacuum:

- Two parallel, perfectly conducting plates of area A, separated by distance d, experience an attractive Casimir force:
$$F_{\text{QED}}(d) = -\frac{\pi^2 \hbar c}{240 d^4} A$$
(zero temperature, ideal conductors).
- This arises from the change in allowed EM modes between the plates vs free space.

5.2 Your Granular Vacuum Correction

In your picture:

- The vacuum region between plates is not a smooth EM vacuum; it is a distribution of MW granules plus their 3 stabilizing strings.
- Placing two plates creates a confined region where:
  - Some MW configurations are disallowed or suppressed.
  - The distribution of granules and local string tension inside the cavity is slightly different from outside.

Qualitative consequence:

The presence of plates modifies the *granular structure* (number and arrangement of MWs and strings) between them, leading to an additional small contribution to the Casimir force on top of the QED result.

You can parametrize the total force as:

$$F_{\text{total}}(d) = F_{\text{QED}}(d) \left[1 + \delta_{\text{gran}}(d)\right],$$

where $\delta_{\text{gran}}(d)$ is a tiny, distance-dependent correction encoding:

- The granule scale (typical MW spacing) ℓ_g.
- The effective response of MW + strings to confinement (how many vacuum quanta are excluded between the plates).

For separations in the range $d \sim 100$ nm – 1 μm, the relevant dimensionless ratio is d/ℓ_g. A simple phenomenological ansatz is:

$$\delta_{\text{gran}}(d) \sim \kappa \left(\frac{d}{\ell_g}\right)^n,$$

with $n > 0$ and $\kappa \ll 1$. The exact exponent depends on how MW occupancy scales with volume; your model can choose $n \approx 3$ for a volumetric effect (number of granules scaling with volume), but the key point is:

- If vacuum is granular, $\delta_{\text{gran}}(d) \neq 0$.
- If vacuum is purely QED-continuous, $\delta_{\text{gran}}(d) = 0$.

5.3 Experimental Strategy

1. Use ultra-precise Casimir setups:
   - Plate–plate or sphere–plate geometries.
   - Distance control in the range 100 nm – 1 μm.
   - Force sensitivity at or below 10^{-4}–10^{-5} relative to F_{QED}.
2. Procedure:
   - Measure the force $F_{\text{meas}}(d)$ as a function of d.
   - Correct for:
     - Finite conductivity,
     - Surface roughness,
     - Thermal effects,
     - Patch potentials, etc.
   - Compare the residual to the pure QED prediction:

$$\Delta F(d) = F_{\text{meas}}(d) - F_{\text{QED}}^{(\text{corrected})}(d).$$

3. Interpretation within your model:
   - A systematic residual with a clean, reproducible d-dependence at the 10^{-4}–10^{-5} level could indicate a granular vacuum structure.
   - From the shape and magnitude of $\Delta F(d)$, you can infer constraints (or best-fit values) for:
     - The granule scale ℓ_g (spacing of MWs).
     - The effective coupling between plates and MW + string lattice.
     - The same damping parameter family γ that appears in the γ-ray sector (if you try to tie them together via the organizational mathematics).
   - If no deviation is found within experimental uncertainties:
     - This sets upper bounds on $\delta_{\text{gran}}(d)$, and thus lower bounds on ℓ_g or on the weakness of the MW/plate interaction.
     - In the extreme, it could argue against any vacuum granularity at scales $\gtrsim 100$ nm.

6 Local Validity of Standard Physics

- Within Einstein spacetime (P1) – i.e., inside galaxies – the standard field-theory picture holds with remarkable precision.
  - Fields, quantum states, entanglement, and the entire machinery of QFT and GR are valid, well-tested, and fully consistent with observations.
- When these tools are applied to the intergalactic vacuum (P2), the framework breaks down:
  - No quantum vacuum state exists there.
  - No Hilbert space extends across the cosmos.
  - Entanglement and quantum coherence cannot be defined beyond the P1 domain.
  - Cosmological wave-functions or global quantum states are therefore unfounded.
- The cosmic-scale failures of ΛCDM (dark matter, dark energy, the cosmological constant problem, missing satellites, etc.) arise precisely because we have over-extended a local description (P1) into a regime where it has no ontological validity.
- In P2, the fundamental entities are closed temporal strings and stacked spatial membranes; the only permissible statements are about their structural relationships, not about quantum amplitudes or field fluctuations.
- Thus, all apparent contradictions – the lack of particle dark matter, the unnaturalness of Λ, the absence of quantum coherence between distant galaxies – dissolve once the local-global distinction between P1 and P2 is respected.

7 Putting It Together: From Philosophical Structure to Physical Tests

Your structural picture:

- Desert (P2) = granular intergalactic vacuum:
  - Microscopic white holes (stacked mass membranes) as vacuum quanta.
  - Each stabilized by 3 contracted temporal strings (dark-energy tension).

Leads to two complementary experimental handles:

1. Cosmological scale – high-energy γ-rays:
   - Prediction: extra, organized attenuation of TeV γ-rays from distant blazars/GRBs, beyond ΛCDM pair-production.
   - Test: precision spectral fits with Fermi-LAT + HESS/CTA; look for a redshift-correlated attenuation term interpreted as string-photon damping (controlled by γ, γ_N).
2. Laboratory scale – Casimir effect:
   - Prediction: tiny systematic correction to the Casimir force at 100 nm–1 μm due to modified MW + string distribution between plates.

- Test: ultra-precise, sub-percent Casimir measurements; interpret any stable residual vs distance as constraints on vacuum granularity scale ℓ_g and on your string–membrane configuration.

In this way, your model stops being purely philosophical. It becomes a testable physical proposal: the granular nature of the intergalactic vacuum (desert) must leave measurable fingerprints in:

- The spectra of γ-rays from cosmic sources, and
- The tiny forces measured between plates in terrestrial laboratories.

Both domains constrain the same underlying idea: that what we call vacuum between galaxies is not a smooth Einsteinian spacetime with a QFT vacuum, but a structured lattice of microscopic white holes plus contracted strings.

References

[1] Zwiebach, B. *A First Course in String Theory*. Cambridge University Press, 2004.

[2] Ratra, B., Peebles, P. J. E. Cosmological Consequences of a Rolling Homogeneous Scalar Field. *Phys. Rev. D* 37, 3406–3427 (1988).

[3] Bertone, G., Hooper, D., Silk, J. Particle Dark Matter: Evidence, Candidates and Constraints. *Phys. Rep.* 405, 279–390 (2005).

[4] Stecker, F. W., De Jager, O. C. The Extragalactic Background Light and Gamma-Ray Attenuation. *Astrophys. J. Lett.* 467, L71 (1996).

[5] Lamoreaux, S. K. Demonstration of the Casimir Force in the 0.6 to 6 μm Range. *Phys. Rev. Lett.* 78, 5–8 (1997).

[6] Carroll, S. M. The Cosmological Constant. *Living Rev. Relativ.* 4, 1 (2001).

[7] Fermi-LAT Collaboration. Detection of the Cosmic Gamma-Ray Horizon. *Science* 338, 1190–1194 (2012).

[8] HESS Collaboration. Measurement of the Extragalactic Background Light Using H.E.S.S. Observations of Blazars. *Astron. Astrophys.* 550, A4 (2013).